## *X-ray ionization of potassium excited with femtosecond laser pulses*

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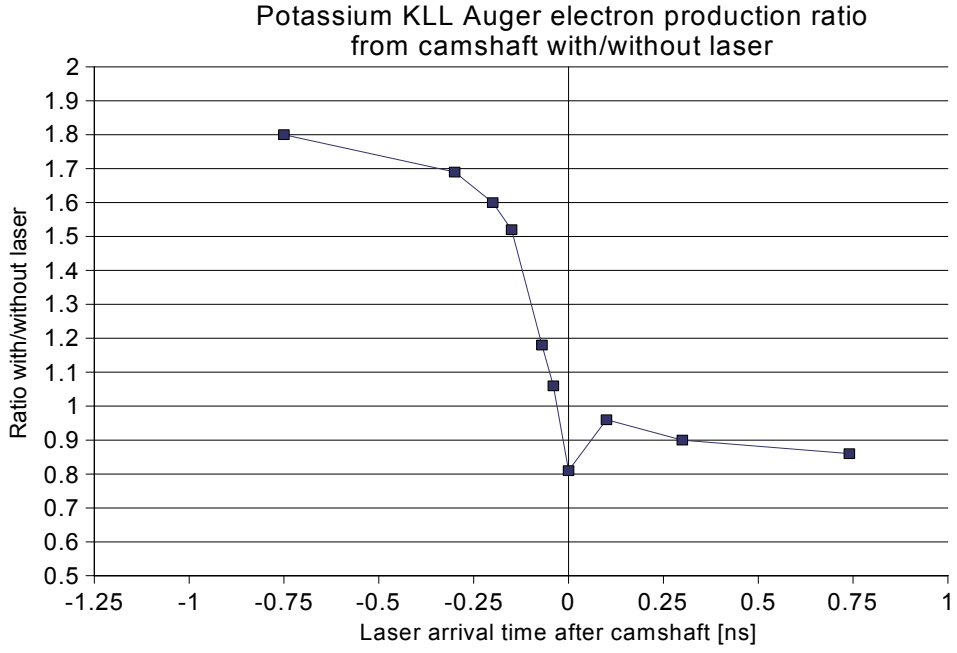
An atom is a multielectron system that responds as a whole when perturbed by a strong laser field. The modifications to the atomic structure by the femto-second laser (acting on the outer electrons only) can indirectly extend to inner-shells through electron correlation. In particular the presence of the laser during relaxation of an atom with an inner-shell hole will modify the autoionization of the upper states as well as the post-collision interactions (e.g. between photo- and Auger electrons) changing the end products.

We used a 1.5 mJ, 800 nm, femtosecond laser pulse as a pump and synchrotron radiation x-rays at the ALS as a probe. The laser is used to remove or excite the 4s-electron of potassium and while the x-rays are tuned around the K-shell ionization threshold to probe the shifts of the transition energies and the continuum.

We observe a laser induced three electron-volt shift of the 1s-4p transition from 3608 eV to 3611 eV. We also observe a two electron-volt shift the ionization threshold from 3613 eV to 3615 eV. This shows that changes to the valence electrons using a femtosecond laser result in major changes in the x-ray absorption edges.

We tuned the x-ray energy to 3611 eV and varied the time delay between the laser pulse and x-ray pulse. We measured a cross correlation between the x-ray beam and the laser pulse that reflect the 50-70 ps time width of the ALS pulse.



The experimental technique is based on the detection of Auger electrons using a high efficiency magnetic spectrometer and time-of-flight. This technique is well suited for studies involving femtosecond x-ray and will be used with the sliced x-ray beam next year on beamline 6 at the ALS and at LCLS when available.